Lecture Notes in Computer Science **10554**

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

More information about this series at http://www.springer.com/series/7412

M. Jorge Cardoso · Tal Arbel et al. (Eds.)

Fetal, Infant and Ophthalmic Medical Image Analysis

International Workshop, FIFI 2017
and 4th International Workshop, OMIA 2017
Held in Conjunction with MICCAI 2017
Québec City, QC, Canada, September 14, 2017
Proceedings

Springer

Editors
M. Jorge Cardoso
University College London
London, UK

Tal Arbel
McGill University
Montreal, Canada

Workshop Editors *see next page*

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-67560-2 ISBN 978-3-319-67561-9 (eBook)
DOI 10.1007/978-3-319-67561-9

Library of Congress Control Number: 2017952887

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Workshop Editors

International Workshop on Fetal and Infant Image Analysis, FIFI 2017

Andrew Melbourne
University College London
London
UK

Michael Ebner
University College London
London
UK

Pim Moeskops
Eindhoven University of Technology
Eindhoven
The Netherlands

Antonios Makropoulos
Imperial College London
London
UK

Ernst Schwartz
Medical University of Vienna
Vienna
Austria

Adrien Desjardin
University College London
London
UK

Emma Robinson
Imperial College London
London
UK

Tom Vercauteren
University College London
London
UK

4th International Workshop on Ophthalmic Medical Image Analysis, OMIA 2017

Hrvoje Bogunovic
Medical University of Vienna
Vienna
Austria

Emanuele Trucco
University of Dundee
Dundee
UK

Xinjian Chen
Soochow University
Suzhou
China

Yanwu Xu
A*STAR Institute for Infocomm Research
Singapore
Singapore

Mona K. Garvin
University of Iowa
Iowa City, IA
USA

Preface FIFI 2017

The application of sophisticated analysis tools to fetal, infant and paediatric imaging data is of interest to a substantial proportion of the MICCAI community. The main objective of this workshop is to bring together researchers in the MICCAI community to discuss the challenges of image analysis techniques as applied to the fetal and infant setting. Advanced medical image analysis allows the detailed scientific study of conditions such as prematurity and the study of both normal singleton and twin development in addition to less common conditions unique to childhood. This workshop brings together methods and experience from researchers and authors working on these younger cohorts and provides a forum for the open discussion of advanced image analysis approaches focused on the analysis of growth and development in the fetal, infant and paediatric period.

September 2017

Andrew Melbourne
Pim Moeskops
Ernst Schwartz
Emma Robinson
Michael Ebner
Antonios Makropoulos
Adrien Desjardins
Tom Vercauteren

Organization

Organizing Committee

Andrew Melbourne	University College London, London, UK
Pim Moeskops	Eindhoven University of Technology, Eindhoven, The Netherlands
Ernst Schwartz	Medical University of Vienna, Vienna, Austria
Emma Robinson	Imperial College London, London, UK
Michael Ebner	University College London, London, UK
Antonios Makropoulos	Imperial College London, London, UK
Adrien Desjardins	University College London, London, UK
Tom Vercauteren	University College London, London, UK

Program Committee

Andrew Melbourne	University College London, UK
Pim Moeskops	Eindhoven University of Technology, The Netherlands
Ernst Schwartz	Medical University of Vienna, Austria
Emma Robinson	Imperial College London, UK
Michael Ebner	University College London, UK
Antonios Makropoulos	Imperial College London, UK
Adrien Desjardins	University College London, UK
Tom Vercauteren	University College London, UK
Guotai Wang	University College London, UK
Nishikant Deshmukh	Johns Hopkins University, USA
Roxane Licandro	Medical University of Vienna, Austria
Sebastiano Ferraris	University College London, UK

Preface OMIA 2017

Age-related macular degeneration, diabetic retinopathy, and glaucoma are the main causes of blindness. Oftentimes blindness can be avoided by early intervention, making computer-assisted early diagnosis of retinal diseases a research priority. Related research is exploring retinal biomarkers for systemic conditions like dementia, cardiovascular disease, and complications of diabetes. Significant challenges remain, including reliability and validation, effective multimodal analysis (e.g., fundus photography, optical coherence tomography, and scanning laser ophthalmoscopy), more powerful imaging technologies, and the effective deployment of cutting-edge computer vision and machine learning techniques. The Fourth International Workshop on Ophthalmic Medical Image Analysis (OMIA-4) addresses all these aspects and more, this year in collaboration with the ReTOUCH retinal image challenge.

September 2017

Hrvoje Bogunovic
Xinjian Chen
Mona K. Garvin
Emanuele Trucco
Yanwu Xu

Organization

Organizing Committee

Hrvoje Bogunovic	Medical University of Vienna, Austria
Xinjian Chen	Soochow University, China
Mona K. Garvin	University of Iowa, USA
Emanuele Trucco	VAMPIRE project, University of Dundee, UK
Yanwu Xu	Institute for Infocomm Research, A*STAR, Singapore

Program Committee

Bashir Al-Diri	University of Lincoln, UK
Philippe Burlina	Johns Hopkins University, USA
Qiang Chen	Nanjing Science and Technology University, China
Jun Cheng	Institute for Infocomm Research, Singapore
Lixin Duan	University of Electronic Science and Technology of China
Huazhu Fu	Institute for Infocomm Research, Singapore
Andrea Giachetti	University of Verona, Italy
Huiying Liu	Institute for Infocomm Research, Singapore
Tom MacGillivray	University of Edinburgh, UK
Xianjing Meng	Shandong University, China
Fabio Scarpa	University of Padova, Italy
Abhay Shah	University of Iowa, USA
Fei Shi	Soochow University, China
Domenico Tegolo	University of Palermo, Italy
Jui-Kai Wang	University of Iowa, USA
Xiaoming Xi	Shandong University, China
Dehui Xiang	Soochow University, China
Mengdi Xu	Institute for Infocomm Research, Singapore
Xiayu Xu	Xi'an Jiaotong University, China
Xenophon Zabulis	Foundation for Research and Technology - Hellas, Greece
Yitian Zhao	Beijing Institute of Technology, China
Yalin Zheng	University of Liverpool, UK
Yuanjie Zheng	Shandong Normal University, China
Weifang Zhu	Soochow University, China

Contents

International Workshop on Fetal and Infant Image Analysis, FIFI 2017

Template-Free Estimation of Intracranial Volume: A Preterm Birth Animal Model Study 3
Juan Eugenio Iglesias, Sebastiano Ferraris, Marc Modat, Willy Gsell, Jan Deprest, Johannes L. van der Merwe, and Tom Vercauteren

Assessing Reorganisation of Functional Connectivity in the Infant Brain 14
Roxane Licandro, Karl-Heinz Nenning, Ernst Schwartz, Kathrin Kollndorfer, Lisa Bartha-Doering, Hesheng Liu, and Georg Langs

Fetal Skull Segmentation in 3D Ultrasound via Structured Geodesic Random Forest 25
Juan J. Cerrolaza, Ozan Oktay, Alberto Gomez, Jacqueline Matthew, Caroline Knight, Bernhard Kainz, and Daniel Rueckert

Fast Registration of 3D Fetal Ultrasound Images Using Learned Corresponding Salient Points 33
Alberto Gomez, Kanwal Bhatia, Sarjana Tharin, James Housden, Nicolas Toussaint, and Julia A. Schnabel

Automatic Segmentation of the Intracranial Volume in Fetal MR Images 42
N. Khalili, P. Moeskops, N.H.P. Claessens, S. Scherpenzeel, E. Turk, R. de Heus, M.J.N.L. Benders, M.A. Viergever, J.P.W. Pluim, and I. Išgum

Abdomen Segmentation in 3D Fetal Ultrasound Using CNN-powered Deformable Models 52
Alexander Schmidt-Richberg, Tom Brosch, Nicole Schadewaldt, Tobias Klinder, Angelo Cavallaro, Ibtisam Salim, David Roundhill, Aris Papageorghiou, and Cristian Lorenz

Multi-organ Detection in 3D Fetal Ultrasound with Machine Learning 62
Caroline Raynaud, Cybèle Ciofolo-Veit, Thierry Lefèvre, Roberto Ardon, Angelo Cavallaro, Ibtisam Salim, Aris Papageorghiou, and Laurence Rouet

Robust Regression of Brain Maturation from 3D Fetal Neurosonography Using CRNs 73
Ana I.L. Namburete, Weidi Xie, and J. Alison Noble

4th International Workshop on Ophthalmic Medical Image Analysis, OMIA 2017

Segmentation of Retinal Blood Vessels Using Dictionary Learning Techniques 83
Taibou Birgui Sekou, Moncef Hidane, Julien Olivier, and Hubert Cardot

Detecting Early Choroidal Changes Using Piecewise Rigid Image Registration and Eye-Shape Adherent Regularization 92
Tiziano Ronchetti, Peter Maloca, Christoph Jud, Christoph Meier, Selim Orgül, Hendrik P.N. Scholl, Boris Považay, and Philippe C. Cattin

Patch-Based Deep Convolutional Neural Network for Corneal Ulcer Area Segmentation 101
Qichao Sun, Lijie Deng, Jianwei Liu, Haixiang Huang, Jin Yuan, and Xiaoying Tang

Model-Driven 3-D Regularisation for Robust Segmentation of the Refractive Corneal Surfaces in Spiral OCT Scans 109
Joerg Wagner, Simon Pezold, and Philippe C. Cattin

Automatic Retinal Layer Segmentation Based on Live Wire for Central Serous Retinopathy 118
Dehui Xiang, Geng Chen, Fei Shi, Weifang Zhu, and Xinjian Chen

Retinal Image Quality Classification Using Fine-Tuned CNN 126
Jing Sun, Cheng Wan, Jun Cheng, Fengli Yu, and Jiang Liu

Optic Disc Detection via Deep Learning in Fundus Images 134
Peiyuan Xu, Cheng Wan, Jun Cheng, Di Niu, and Jiang Liu

3D Choroid Neovascularization Growth Prediction with Combined Hyperelastic Biomechanical Model and Reaction-Diffusion Model 142
Chang Zuo, Fei Shi, Weifang Zhu, Haoyu Chen, and Xinjian Chen

Retinal Biomarker Discovery for Dementia in an Elderly Diabetic Population 150
Ahmed E. Fetit, Siyamalan Manivannan, Sarah McGrory, Lucia Ballerini, Alexander Doney, Thomas J. MacGillivray, Ian J. Deary, Joanna M. Wardlaw, Fergus Doubal, Gareth J. McKay, Stephen J. McKenna, and Emanuele Trucco

Non-rigid Registration of Retinal OCT Images Using Conditional Correlation Ratio. 159
Xueying Du, Lun Gong, Fei Shi, Xinjian Chen, Xiaodong Yang, and Jian Zheng

Joint Optic Disc and Cup Segmentation Using Fully Convolutional and Adversarial Networks 168
Sharath M. Shankaranarayana, Keerthi Ram, Kaushik Mitra, and Mohanasankar Sivaprakasam

Automated Segmentation of the Choroid in EDI-OCT Images with Retinal Pathology Using Convolution Neural Networks 177
Min Chen, Jiancong Wang, Ipek Oguz, Brian L. VanderBeek, and James C. Gee

Spatiotemporal Analysis of Structural Changes of the Lamina Cribrosa 185
Charly Girot, Hiroshi Ishikawa, James Fishbaugh, Gadi Wollstein, Joel Schuman, and Guido Gerig

Fast Blur Detection and Parametric Deconvolution of Retinal Fundus Images 194
Bryan M. Williams, Baidaa Al-Bander, Harry Pratt, Samuel Lawman, Yitian Zhao, Yalin Zheng, and Yaochun Shen

Towards Topological Correct Segmentation of Macular OCT from Cascaded FCNs. 202
Yufan He, Aaron Carass, Yeyi Yun, Can Zhao, Bruno M. Jedynak, Sharon D. Solomon, Shiv Saidha, Peter A. Calabresi, and Jerry L. Prince

Boosted Exudate Segmentation in Retinal Images Using Residual Nets 210
Samaneh Abbasi-Sureshjani, Behdad Dashtbozorg, Bart M. ter Haar Romeny, and François Fleuret

Development of Clinically Based Corneal Nerves Tortuosity Indexes. 219
Fabio Scarpa and Alfredo Ruggeri

A Comparative Study Towards the Establishment of an Automatic Retinal Vessel Width Measurement Technique 227
Fan Huang, Behdad Dashtbozorg, Alexander Ka Shing Yeung, Jiong Zhang, Tos T.J.M. Berendschot, and Bart M. ter Haar Romeny

Automatic Detection of Folds and Wrinkles Due to Swelling of the Optic Disc 235
Jason Agne, Jui-Kai Wang, Randy H. Kardon, and Mona K. Garvin

Representation Learning for Retinal Vasculature Embeddings 243
Luca Giancardo, Kirk Roberts, and Zhongming Zhao

Author Index 251